TECHNICAL REPORT

ISO/IEC TR 15504-8

First edition
1998-08-15

Information technology — Software process assessment —

Part 8:
Guide for use in determining supplier process capability

Technologies de l'information — Évaluation des procédés du logiciel —

Partie 8: Guide pour l'utilisation dans la détermination de la capacité du procédé du fournisseur

Reference number
ISO/IEC TR 15504-8:1998(E)

Contents

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

The main task of technical committees is to prepare International Standards, but in exceptional circumstances a technical committee may propose the publication of a Technical Report of one of the following types:

— type 1, when the required support cannot be obtained for the publication of an International Standard, despite repeated efforts;

— type 2, when the subject is still under technical development or where for any other reason there is the future but not immediate possibility of an agreement on an International Standard;

— type 3, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example).

Technical Reports of types 1 and 2 are subject to review within three years of publication, to decide whether they can be transformed into International Standards. Technical Reports of type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.

ISO/IEC TR 15504-8, which is a Technical Report of type 2, was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology,* Subcommittee SC 7, *Software engineering*.

ISO/IEC TR 15504 consists of the following parts, under the general title *Information technology — Software process assessment* :

— *Part 1: Concepts and introductory guide*

— *Part 2: A reference model for processes and process capability*

— *Part 3: Performing an assessment*

— *Part 4: Guide to performing assessments*

— *Part 5: An assessment model and indicator guidance*

— *Part 6: Guide to competency of assessors*

— *Part 7: Guide for use in process improvement*

— *Part 8: Guide for use in determining supplier process capability*

— *Part 9: Vocabulary*

Information technology — Software process assessment —

Part 8:
Guide for use in determining supplier process capability

1 Scope

This part of ISO/IEC TR 15504 provides guidance on utilizing process assessment for the purposes of process capability determination. This part of ISO/IEC TR 15504 is informative and is intended to provide guidance on how to apply the requirements.

A process capability determination is a systematic assessment and analysis of selected software processes within an organization, carried out with the aim of identifying the strengths, weaknesses and risks associated with deploying the processes to meet a particular specified requirement.

The specified requirement may involve a project, product or a service, a new or an existing task, a contract or an internal undertaking, or any other requirement which is to be met by deploying an organization's software processes.

This guidance is intended to be applicable across all software application domains, over all software organizational structures, within any software customer-supplier relationship, and to any organization wishing to determine the process capability of its own software processes.

This part of ISO/IEC TR 15504 is primarily aimed at:

— the sponsor who initiates the process capability determination;

— the organization whose process capability is to be determined;

— the assessment team;

— method developers.

ISO/IEC TR 15504 is not intended to be used in any scheme for the certification/registration of the process capability of an organization.

2 Normative reference

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO/IEC TR 15504. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO/IEC TR 15504 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO/IEC TR 15504-9:1998, *Information technology — Software process assessment — Part 9: Vocabulary*.

3 Terms and definitions

For the purposes of this part of ISO/IEC TR 15504, the terms and definitions given in ISO/IEC TR 15504-9 apply.

4 Introduction to process capability determination

4.1 Overview

4.1.1 Purpose

A process capability determination is a systematic assessment and analysis of selected software processes within an organization, carried out with the aim of identifying the strengths, weaknesses and risks associated with deploying the processes to meet a particular specified requirement.

One of the main reasons for carrying out a process capability determination is to obtain information upon which to base a procurement-related decision. A procurer may initiate a process capability determination to assess the risk of entering into a contract with a particular supplier. The procurer may carry out process capability determinations on a number of competing suppliers during a pre-contract supplier selection activity; software process capability is of course only one of the factors taken into account during supplier selection. Conversely, suppliers may wish to carry out a process capability determination on their own processes before deciding whether to bid for a contract, as part of their own assessment of the business risks involved. A process capability determination may also be initiated for a number of other reasons; for example, by a supplier during the course of a project to establish the risks involved in completing the work.

Process capability determination may be applied to a variety of situations: the specified requirement may involve a new or an existing task, a contract or an internal undertaking, a product or a service, or any other requirement which is to be met by deploying an organization's software processes.

4.1.2 Core and extended process capability determination

This part of ISO/IEC TR 15504 presents two alternative approaches to process capability determination described below.

Core process capability determination is a minimum, streamlined set of activities applicable whenever a single organization proposes to meet a specified requirement by deploying its current process capability, without any partners or sub-contractors being involved.

Extended process capability determination is applicable when an enhanced capability is proposed, or when consortia or sub-contractors are involved.

In either case the conduct of process capability determination is described in three separate stages, as set out in clause 5.

4.1.3 Compatible assessment methods and models

ISO/IEC TR 15504-3 sets out the minimum requirements for performing an assessment in order to ensure consistency and repeatability of the process assessment ratings. The requirements help to ensure that the assessment output is internally self-consistent, and provides evidence to substantiate the ratings and to verify compliance with the requirements. ISO/IEC TR 15504-2 sets out compatibility requirements which enable outputs from assessments conducted with different, compatible assessment models to be compared. They include requirements for mapping from the fundamental elements of the compatible model to the processes and process attributes of the reference model. The guidance contained in this part of ISO/IEC TR 15504 is intended to apply to outputs from assessments performed with compatible models after they have been mapped onto the reference model.

4.1.4 Basis of process capability determination

The output of a process assessment which has been mapped to the reference model is a set of process profiles. These profiles represent the capability of the organization's implementation of the processes in a particular assessment context and are reusable for both process capability determination and process improvement in that particular context or a similar context.

4.1.5 Assessment approaches

Either self-assessment or independent assessment approaches may be used during a process capability determination. In a two-party contractual situation, a procurer may wish to invite potential suppliers to provide a self-assessment profile - produced from an assessment using compatible models and mapped to the reference model - when submitting a proposal for a contract. Such an approach offers the benefit of sharing both the cost and the benefit of the process assessment, since suppliers may also use the assessment results within their own process improvement programmes.

The procurer may choose to:

— initiate and rely entirely upon a full independent assessment and make this a condition of contract award;

— accept a self-assessment at face value;

— initiate an independent sample assessment to verify that the self-assessment is a true representation of the supplier's process capability.

ISO/IEC TR 15504 thus offers the benefit of reducing disruption to suppliers' business activities caused by multiple process assessments, since the same assessment results may be offered to many procurers. It also provides procurers with a rigorous and defensible approach to supplier process capability determination, and the potential to reduce assessment costs through the reuse of results and the utilization of self-assessments.

4.1.6 Process-oriented risk

During a process capability determination, a selection of an organization's software processes are assessed and the results analysed to identify strengths, weaknesses and risks. Process capability determination does not address all aspects of risk, which may include strategic, organizational, financial, personnel and many other factors. The output from a process capability determination feeds into this wider risk analysis, but confines itself to *process-oriented risk*.

The process architecture of ISO/IEC TR 15504 rests on the reference model. This model sets out 40 processes and defines the purpose and outcomes of each, as well as a set of nine process attributes which apply to all processes. The process attributes are concerned with process management and are grouped into ordered capability levels, which progressively describe major enhancements to process capability. The single process attribute in the *Performed* capability level measures the extent to which the execution of a process uses a set of practices that transform identifiable input work products into identifiable output work products and satisfy the defined process purpose. Additional, user-defined processes can also be added if required.

During a compatible process assessment, individual process attributes are rated by competent assessors against either a percentage scale representing the extent of achievement of the attribute, or a 4-point ordinal scale whereby process attributes are rated as fully, largely, partially or not achieved. ISO/IEC TR 15504-2 describes the relationship between the two scales. The guidance presented within this part of ISO/IEC TR 15504 uses the 4-point representation exclusively. Ratings are made utilising an appropriate set of indicators of process performance and an appropriate set of indicators of process capability.

The nine process attribute ratings for an assessed process form its process profile. Process attribute ratings for several process may then be collected into a process capability profile that indicates, for each process assessed, which process attributes are being achieved. Process ratings are described in ISO/IEC TR 15504-2.

The key to process-oriented risk lies in the reference model, the good process management practices it reflects through the process attributes, and the benefits that arise from deploying them. Process-oriented risk arises from inappropriate process management - i.e. not deploying appropriate management practices, or from deploying them in a way which is assessed in the particular context as not achieving the required process attributes.

4.1.7 Key processes

Within this part of ISO/IEC TR 15504, the capability of a process is expressed in terms of the achievement of its process attributes.

The sponsor of the process capability determination may be a procurer initiating a process capability determination to determine whether a potential supplier's processes are suitable for a particular requirement, or an organization initiating a process capability determination to determine whether its own processes are suitable.

The sponsor determines which of the 40 process in the reference model will be most important to meeting the specified requirement. These processes are termed the *key processes* for the process capability determination. The sponsor lists the key processes within a target capability statement, and states - for each key process - which process attributes are required, and - for each attribute - what achievement rating is deemed necessary.

The target capability is chosen to be that capability which the sponsor judges will represent a minimal process risk to the successful implementation of the specified requirement.

4.1.8 Process-oriented risk analysis

Within this part of ISO/IEC TR 15504, process-oriented risk is assessed firstly from the *probability* of a particular problem occurring, and secondly from its potential *impact*, should it occur.

Suppose that a sponsor indicates in a target capability statement that a particular process attribute should be fully achieved for a particular process. The assessed achievement of the process attribute is less than fully achieved. There is therefore a gap between target and assessed attributes which increases the probability that the process will not contribute satisfactorily towards meeting the specified requirement. If the sponsor believes that, for a particular process, all of the process attributes up to and including the *Managed* capability level should be fully achieved, and if the assessed process profile shows that the process attribute at the *Performed* capability level is not fully achieved, then a major gap exists and there is a high probability of a problem occurring.

The potential impact of the problem depends upon the capability level within which it occurs. For example, if a key process is assessed less than fully performed, as reflected by the rating for the Process Performance attribute at the *Performed* capability level, then the process is incomplete and this may lead to missing work products, or unacceptable product quality, or both.

4.1.9 Output

The output of a process capability determination is the process capability report. It summarizes, for each key process included within the target capability statement, strengths and weaknesses expressed in terms of process attribute gaps, and the risks associated with each.

4.2 Target capability

Sponsors may wish to develop or purchase an appropriate method for defining target capability. A number of approaches are possible, but most will be based on the following principles.

The target capability is chosen to be that capability which the sponsor judges will represent a minimal process risk to the successful implementation of the specified requirement.

Target capability is expressed within a target capability statement, which lists processes key to meeting the specified requirements and states, for each key process, the required achievement of each process attribute.

Only process attribute achievement targets of *fully*, or *largely*, or *not required* should be set.

For each key process, sponsors should identify which process attributes are required, and set the degree of achievement for each. Process attribute achievement may be set in several ways. For example, the same degree of achievement may be allocated to:

a) all of the process attributes up to a certain capability level;

b) individually selected process attributes.

Table 1 illustrates a target capability statement.

Table 1 — Example target capability statement

Key Process	Process Attributes	Process attribute ratings required
CUS.3 Requirements elicitation	PA1.1, PA2.1, PA2.2 (i.e. all up to and including the *Managed* capability level)	Fully Achieved
CUS.4.2 Customer support	PA1.1, PA2.1, PA2.2, PA3.1, PA3.2 (i.e. all up to and including the *Established* capability level)	Fully Achieved
ENG.1.3 Software design	PA1.1, PA2.1, PA2.2, PA3.1, PA3.2	Fully Achieved
ENG.1.4 Software construction	PA1.1, PA2.1, PA2.2, PA3.1, PA3.2	Fully Achieved
	PA4.1, PA4.2	Largely Achieved
ENG.1.6 Software testing	PA1.1, PA2.1, PA2.2, PA3.1, PA3.2	Fully Achieved
	PA4.1, PA4.2	Largely Achieved
MAN.2 Project management	PA1.1, PA2.1, PA2.2	Fully Achieved
	PA3.1, PA3.2	Largely Achieved
MAN.3 Quality management	PA1.1, PA2.1, PA2.2	Fully Achieved
	PA3.1, PA3.2	Largely Achieved
SUP.2 Configuration management	PA1.1, PA2.1, PA2.2	Fully Achieved
	PA3.1, PA3.2	Largely Achieved

A number of approaches to setting target capability are possible. One approach is to:

a) identify a set of initial key processes;

b) set default process attribute achievement targets for the set of initial key processes;

c) review and adjust the default process attribute achievement targets;

d) add further processes, and set achievement targets for the further processes.

These steps are described in the following paragraphs.

4.2.1 Initial key processes

The processes in the reference model which contribute most directly to the delivery of products and services are those within the *Customer-Supplier* and *Engineering* process categories. Processes from the *Management, Support* and *Organization* process categories provide a more indirect contribution.

Key processes are identified, starting with the processes in the *Customer-Supplier* and *Engineering* process categories. Any processes in these categories which are not relevant to the specified requirement should be eliminated, and the remainder designated as the initial set of key processes.

4.2.2 Default process attribute achievement targets

A good starting position is to state, for each key process, that all of the process attributes in the first three capability levels - *Performed, Managed,* and *Established* - should be rated as fully achieved, with the other process attributes not being specified.

This approach ensures firstly that processes are complete and fully performed; secondly that management practices are in place to reduce unpredictability, missed deadlines, budget overspend and reduced output quality; and thirdly that processes are deployed following organization-wide standard process definitions, thus providing confidence that future performance will be consistent with past accomplishments.

4.2.3 Reviewing and adjusting process attribute achievement targets

Requiring that process attributes in the *Predictable* capability level should also be fully or largely achieved for a given process may reduce performance risks. For instance, a particular specified requirement may demand that some processes be controlled quantitatively. Process attributes within the *Optimizing* capability level may occasionally also be needed, but for many organizations, this degree of process management may not yet be practical. Alternatively, sponsors may feel that for a particular key process, only process attributes within the first two capability levels are appropriate.

4.2.4 Adding further processes

Many process attributes are related to processes within the Management, Support and Organization process categories.

For example, if the *Performance Management* attribute (PA2.1) has been included for a process within the Engineering process category, then the *Project Management* process within the Management process category should also be included as a key process.

The target capability for processes in the Management, Support and Organization process categories is determined by the extent to which they support process attributes applying to the initial set of key processes. Other processes from the Support, Management and Organization process categories may also be included in the target capability statement where they are relevant to the specified requirement.

Note that the specified requirement may be for an organizational capability, rather than a product or service. The specified requirement may be to establish a strong configuration management process as an end in itself, and the key process set would then include just this single process. This class of specified requirement would arise from an organization's business goals and priorities.

4.3 Process-oriented risk analysis

A number of approaches to analysing process-oriented risk are possible. One approach is to infer process-oriented risk from the existence of gaps between target capability and assessed capability. If the target capability statement indicates that a particular process attribute should be fully achieved, while the assessed process attribute rating is less than fully achieved, then a gap is said to exist.

Within this approach, process-oriented risk is assessed firstly from the probability of a particular problem occurring, and secondly from the nature of its impact. The probability is derived from the extent of any gaps between an assessed capability profile and a target capability statement. The nature of the impact depends upon the capability level within which the gap occurs.

4.3.1 Assessed capability profile

The assessed capability profile will be in the form of an output from a process assessment which has been mapped to the reference model. This profile will contain process attribute ratings as defined in ISO/IEC TR 15504-2, paragraph 6.7.4. For each process assessed and for each process attribute, the process attribute rating profile

indicates which process attributes have been assessed fully, largely, partially or not achieved. Figure 1 illustrates how the process attribute ratings appear.

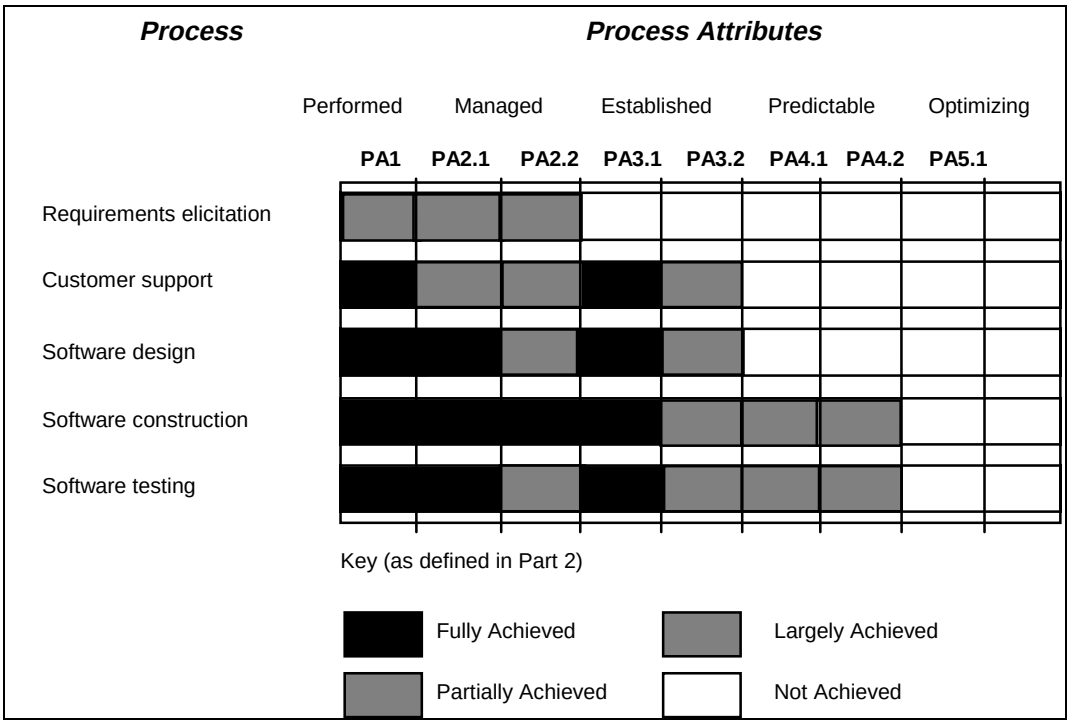

Figure 1 — Assessed capability profile

A process attribute represents a measurable characteristic of a process. The process attribute rating is a judgement, within the process context, of the extent to which the process attribute is achieved.

Because process attributes are defined in this way, process assessment is highly context-sensitive. For example, an organization developing a large, complex and safety-critical software system would need to deploy a highly refined process in order to be assessed fully achieved at the *Performed* level. In contrast an organization working on straightforward, non-critical applications would need far less sophistication to attain a similar assessment result. Therefore process capability ratings are meaningful only within their stated process context.

4.3.2 Target capability statement

Figure 2 shows one way that a target capability statement might be illustrated, along with the example assessed capability profile from figure 1.

In this example the sponsor has deemed that for the first process, *Requirements Elicitation,* all of the process attributes up to and including the *Managed* level should be fully achieved. For the next two processes, all process attributes up to an including the *Established* level should be fully achieved. For the final two processes, not only should the process attributes up to and including the *Established* level be fully achieved, but in addition those of the *Predictable* level should also be largely achieved.

4.3.3 Probability

Within this approach to assessing process-oriented risk, the probability of problems occurring is inferred from the extent of any gap between the target capability and assessed capability.

Process attribute gaps occur whenever an individual process attribute rating falls short of the corresponding rating specified in the target capability statement. Process attribute gaps are designated as shown in table 2.

A *capability level gap* arises whenever there are process attribute gaps within the particular level, and designated as shown in table 3. As can be seen from table 3, a substantial capability level gap is said to arise from a major

process attribute gap at Level 1, whereas minor process attribute gaps constitute only a slight capability level gap at any level.

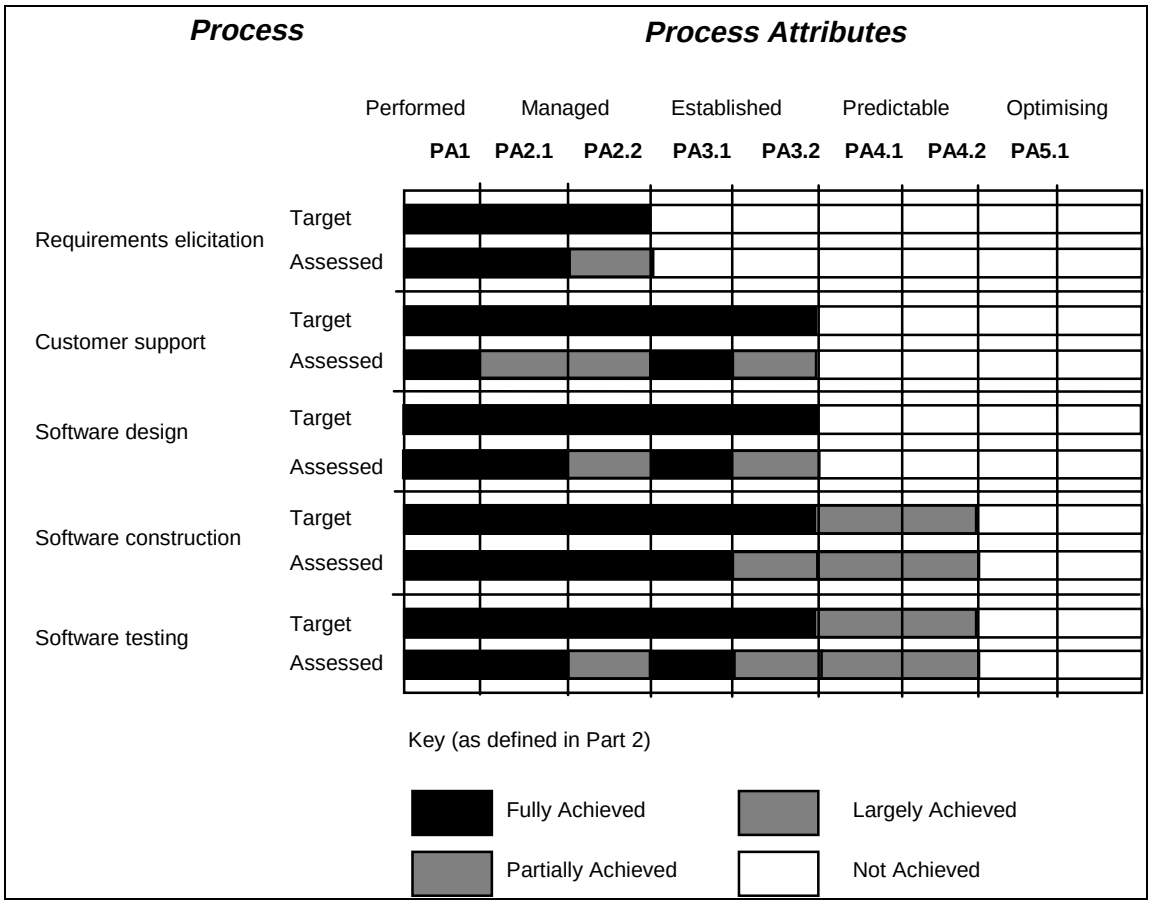

Figure 2 — Target capability with assessed capability

Table 2 — Process attribute gaps

Target rating	Assessed rating	Process attribute gap
Fully Achieved	Fully Achieved	None
	Largely Achieved	Minor
	Partially Achieved	Major
	Not Achieved	Major
Largely Achieved	Fully Achieved	None
	Largely Achieved	None
	Partially Achieved	Major
	Not Achieved	Major

Table 3 — Capability level gaps

Number of process attribute gaps within capability level	Capability level gap
No major or minor gaps	None
Minor gaps only	Slight
A single major gap at Levels 2 - 5	Significant
A single major gap at Level 1, or more than one major gap at Levels 2 - 5	Substantial

4.3.4 Impact

The previous section showed how the probability of problems occurring is inferred from the extent of a gap at a capability level.

The potential *impact* of a particular problem depends upon the *capability level* in which the gap occurs:

— A gap at the Optimising level may lead to reduced cost/time optimisation and reduced ability to cope with changes in technology;

— A gap at the Predictable level may also result in an inability to predict performance or timely detect problems;

— A gap at the Established level may lead, in addition to the above problems, to reduced cost effectiveness, plus reduced spatial and temporal uniformity of performance;

— A gap at the Managed level may further lead to cost or time overruns;

— A gap at the Performed level may lead to all of the above problems, and also - most critically - to missing work products and unacceptable product quality.

4.3.5 Overall risk

Within this approach, the overall process-oriented risk associated with a single process may be summarized as shown in table 4.

To use tables 2 to 4, consider each key process in turn, and then, for each process, consider each capability level in turn. Categorise any process attribute gaps using table 2, and then determine the capability level gap using table 3. For example, a substantial gap within the Managed level implies a high probability of problems arising, which would impact upon budget and schedule. According to table 4, this constitutes a high risk.

If, within a particular process, risks are identified at more than one capability level, then the overall risk for the process is the highest risk identified.

It is emphasized that table 4 is merely a guide to overall risk; nominal risk levels should always be confirmed by a critical review against experience and reality.

It should be noted that a particular row from table 4 is relevant only if the process attributes of the particular capability level have been included in the target capability statement.

Table 4 — Overall process-oriented risk

Location of Capability Level Gap (ie Impact)	*Extent of Capability Level Gap (ie Probability)*			
	None	**Slight**	**Significant**	**Substantial**
Optimizing	No Identifiable Risk	Low Risk	Low Risk	Low Risk
Predictable	No Identifiable Risk	Low Risk	Low Risk	Medium Risk
Established	No Identifiable Risk	Low risk	Medium risk	Medium Risk
Managed	No Identifiable Risk	Medium Risk	Medium Risk	High Risk
Performed	No Identifiable Risk	Medium Risk	High Risk	High Risk

4.4 The process capability report

PROCESS CAPABILITY SUMMARY REPORT

Confidence in Proposed Capability

Confidence that proposed capability is realistic	Largely confident

Process-Oriented Risk

Key Process	Strength/Weakness	Process-oriented risk
ENG.1.5	Assessed capability falls slightly short of target capability at the Established capability level.	Low risk
CUS.4.2	Assessed capability falls slightly short of target capability at the Performed level, substantially short at the Managed level, and substantially short at the Established level.	High risk
SUP.2	Assessed capability falls slightly short of target capability at the Managed level, and significantly short of target capability at the Established level.	Medium risk
ENG.1.4	Assessed capability meets or exceeds target capability in all respects.	No identifiable risk

Figure 3 — Illustration of process capability summary report

The process capability report is the final output of process capability determination. It consists of a summary and a detailed report. The summary consists of three parts:

a) an introduction that describes the context of the process capability determination, who carried it out, and where, when and why it took place;

b) a statement of the sponsor's confidence that the proposed capability is realistic and likely to be brought to bear in meeting the specified requirement. This confidence may be derived from the results of an independent process assessment, or from some other aspect of the sponsor's relationship with the organization;

c) a report, for each key process, of any gap between target capability and proposed capability, and of the process-oriented risk arising from this gap.

Figure 3 illustrates how a summary process capability report might be presented showing the assessed overall risk associated with each process.

The summary report should be supported by a detailed report, showing, for each process within the target capability statement, the target and proposed achievement of every process attribute, listing individual process attribute gaps (designated according to table 2) and summarizing capability level gaps (designated according to table 3).

5 Conducting a process capability determination

Sponsors may wish to develop or purchase an appropriate method to support the conduct of a process capability determination. A number of approaches are possible, but most will be based on either core or extended process capability determination as explained in the following sections.

5.1 Core process capability determination

Core process capability determination is a minimum, streamlined set of activities applicable whenever a single organization proposes to meet a specified requirement by deploying its current process capability, without any partners or sub-contractors being involved.

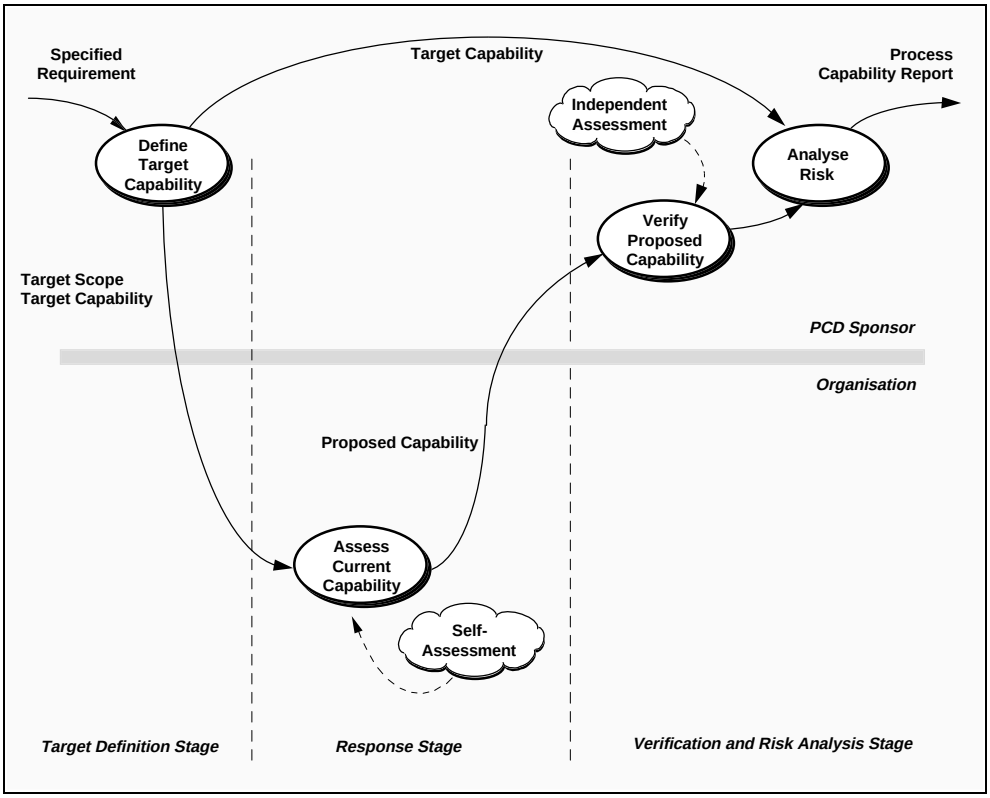

Figure 4 — Core process capability determination

Core process capability determination comprises three stages as illustrated in figure 4. The ovals in figure 4 represent activities; the arrows represent information being passed between activities; and the clouds represent comment.

Throughout clause 4 the term *assessed capability* was used to refer to the output of a process assessment. This clause introduces the term *proposed capability* to represent that process capability which the organization proposes to bring to bear in meeting the specified requirement. For core process capability determination, the proposed capability is the organization's current assessed capability, represented as the output of a recent, relevant process assessment which has been mapped onto the reference model.

5.1.1 The target definition stage

The sponsor is responsible for the target definition stage. The process capability determination is carried out with respect to a specified requirement, which may be expressed in a high-level or detailed form, and may involve a new or existing task, a contract or class of contracts, an internal undertaking, a product or a service, or any other requirement which is to be met by the organization's proposed processes.

During the target definition stage, the sponsor:

— plans and initiates the process capability determination;

— develops the target capability statement;

— defines the target scope - i.e. the process assessment context implied by the specified requirement. This may include a set of key processes which should be included to represent overall organizational capability. It may also include the definitions of any extended processes which the sponsor wishes to include;

— passes the target scope and, optionally, the target capability statement to potential suppliers.

When initiating the process capability determination, sponsors may wish to request supporting details of current similar projects undertaken by the organization, or specify how many processes should be included within any aggregated attribute ratings.

Sponsors may decide either to disclose the target capability statement to potential suppliers, or to retain it for their own use, as they see fit.

5.1.2 The response stage

During the response stage, the organization assesses its current capability with respect to the target scope. The proposed capability profile is aggregated from assessments of a number of current or recent projects, as described in ISO/IEC TR 15504-3. This capability profile:

— should be based on a number of process assessments, conducted according to the provisions of ISO/IEC TR 15504;

— should correspond to the target scope;

— should be a true representation of the organization's current process capability;

— should be owned by the organization;

— will most likely have been the product of self-assessment, but could also have been produced by a previous independent assessment.

A key feature of ISO/IEC TR 15504 is that process assessment results are re-useable. Many organizations will have a repository of process assessment outputs generated as part of a process improvement programme. If a number of suitable process assessments are available, then the organization may use the outputs as the basis of the proposed capability. If not, then the organization carries out a self-assessment in accordance with ISO/IEC TR 15504-3.

5.1.3 The verification and risk analysis stage

5.1.3.1 Verification

The sponsor reviews the proposed capability to establish how much credibility it merits, and decides what further action is needed to establish confidence in it. This will typically involve:

— checking that the assessed capability is the result of an assessment conducted according to a method compatible with the requirements of ISO/IEC TR 15504;

— checking that the context of the proposed capability matches the target scope;

— carrying out an independent assessment of one or more processes.

Among the factors to consider when evaluating the credibility of a proposed capability are:

— previous experience of the reliability of the compatible method;

— previous experience of the reliability of the assessors involved;

— previous experience of the reliability of the capabilities proposed by the organization in question;

— the size of the supplier's assessment team and the assessors' professional credibility (a sponsor may feel that an assessment carried out by a single assessor will provide less confidence than one performed by a team containing one of more independent assessors).

A sponsor may accept the proposed capability or decide to initiate an appropriate degree of independent assessment, bearing in mind the nature, cost and importance of the specified requirement. This independent assessment may involve, for example, a sample of key processes, or a comprehensive independent assessment of all key processes specified in the target capability statement. Having carried out the independent assessment, the sponsor will be able to compare this independent output with the organization's proposed capability and record the level of confidence in the organization's proposed capability in the terms shown in table 5.

Table 5 — Terminology for expressing confidence in proposed capability

Correspondence of independent assessment to proposed capability	Degree of confidence
• The sponsor has no reason to doubt the proposed capability, or • The results of an independent assessment confirm the organization's self-assessed capability.	Fully confident
The results of an independent assessment have varied slightly from the organization's self-assessed capability	Largely confident
The results of an independent assessment have varied significantly from the organization's self-assessed capability	Partially confident
The results of an independent assessment have varied substantially from the organization's self-assessed capability	Not confident

The terms *slightly, significantly* and *substantially* are used here as defined in table 3.

If the process capability determination involves a number of competing suppliers, then sponsors may wish - if it is practical to do so - to employ the same assessment team, using the same assessment method, to verify each supplier's proposed capability. This should not only provide the sponsor with greater confidence in the consistency with which each supplier is assessed, but also provide the suppliers with enhanced confidence in the fairness of the sponsor's selection process.

Following appropriate verification, the proposed capability becomes an input to risk analysis.

5.1.3.2 Risk analysis

Risk analysis is carried out by the sponsor as described in clause 4.

For each key process within the target capability statement, the following steps are followed:

— examine the process attribute rating for each process attribute within the target capability statement, and designate any individual process attribute gaps according to table 2;

— consider each capability level and designate any capability level gaps according to table 3;

— identify the risk corresponding to each capability level gap by referring to table 4;

— record this risk in the process capability report.

5.2 Extended process capability determination

This section provides outline guidance on the additional activities covered within extended process capability determination.

Extended process capability determination is applicable whenever:

— the proposed capability is greater than currently assessed capability; or

— the proposed capability involves a constructed capability (as explained below) with partners or sub-contractors.

Extended process capability determination comprises three stages as illustrated in figure 7. The target definition stage is the same for both core and extended process capability determination. Hence, the following descriptions relate to the *Response* stage and the *Verification And Risk Analysis* stage only.

5.2.1 The response stage

5.2.1.1 Proposing an enhanced capability

The organization's assessed capability may meet or exceed the target capability, but if not, the organization may wish to develop a proposed capability which lies somewhere between the assessed capability and the target capability as illustrated in figure 5.

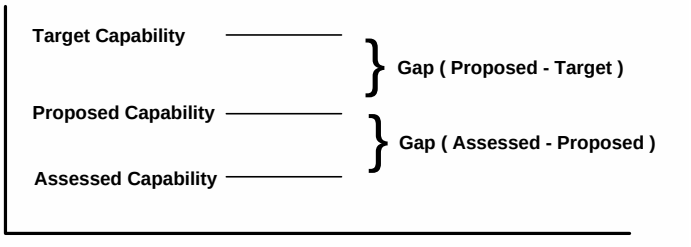

Figure 5 — Target, proposed and assessed capabilities

Since the specified requirement relates to work to be undertaken in the future, the organization may wish to propose an enhanced capability, justified by a currently assessed capability and a process improvement plan. The process improvement plan may in turn be supported by a process improvement track record if the organization already has a process improvement programme in place.

If the organization's proposed capability falls short of the target capability the organization may wish to submit a shortfall plan, addressing each area where process capability falls short of the target capability, setting out the organization's assessment of the shortfall, and proposing measures to mitigate it.

The proposed capability may be derived by examining the gap between the current and target capabilities and interacting with a process improvement process. The process improvement process will balance previously planned improvements with those necessary to close the gap between the current and target capabilities, but may be constrained by available resources.

The process improvement process may return a process improvement plan, setting out details of what has to be done and what resources are required (see ISO/IEC TR 15504-7). If they exist, any process improvement records which add credibility to the plan may also be included, showing what has been achieved in the past.

The organization may therefore wish to pass to the sponsor a proposed capability, justified by:

a) an assessed capability;

b) a process improvement plan;

c) a process improvement track record;

d) a capability shortfall plan.

This additional information is illustrated in figure 6.

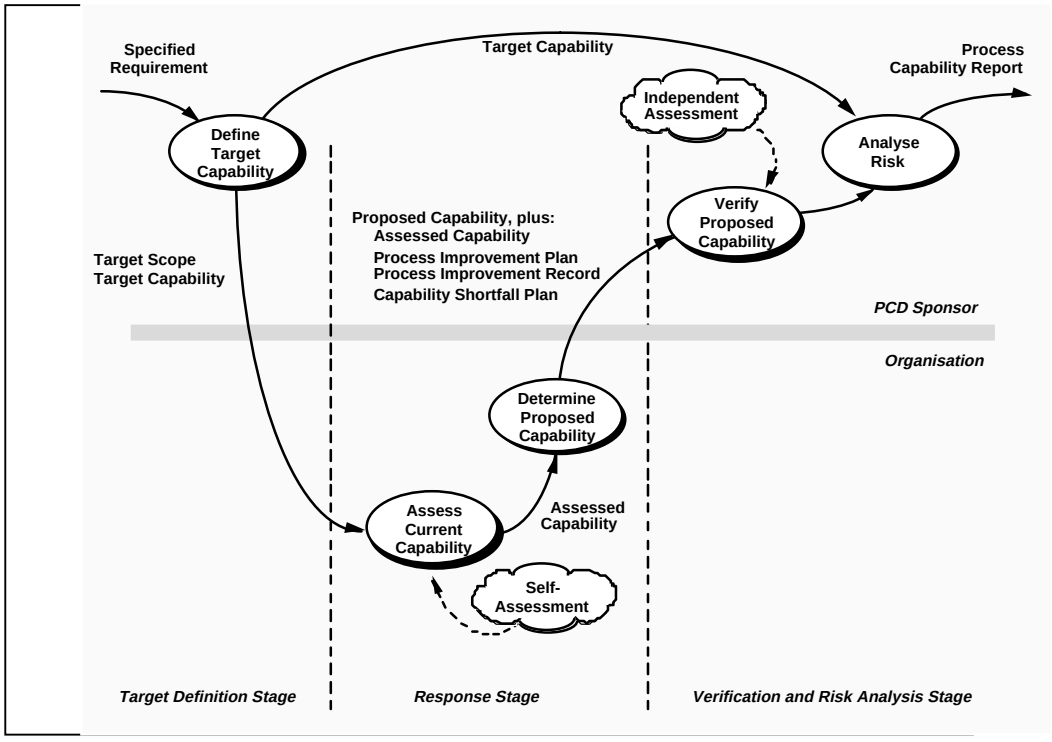

Figure 6 — Extended process capability determination

5.2.1.2 Proposing a constructed capability

The process capability determination will be carried out with respect to a specified requirement which will be worked on in the future. Although the process capability determination will be firmly based on one or more current or recent process assessments, the organization may wish to - or have to - propose a capability which has not yet been constructed. The organization which will undertake the work may not yet exist, and may have to be constructed from existing organizational elements plus sub-contractors, consultants, partners etc. A typical example is illustrated in figure 7.

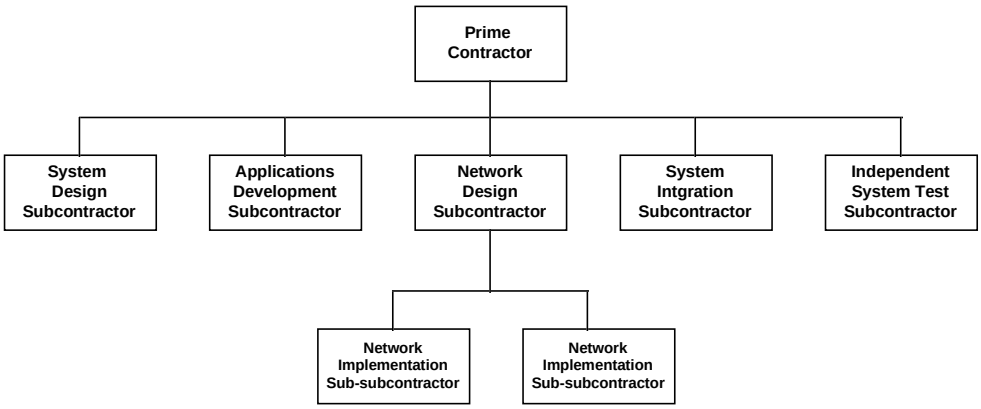

Figure 7 — Constructed capability

There are two different modes that need to be considered when generating a constructed capability from a number of sources.

a) **Disjoint mode**: Each key process is deployed uniquely by an individual organization and the constructed capability simply consists of a set of processes that are selected from two or more organizations.

b) **Conjoint mode**: A number of organizations deploy the same process or processes concurrently; e.g. several organizations developing different sub-systems of an overall requirement.

It is also possible in large or complex contracts to have a mixture of both modes at the same time.

Disjoint mode is used to construct a capability by combining two or more key processes (processes from the CUS and ENG process categories) to meet, or come as close as is possible or deemed appropriate to meeting, a target capability. Each process is performed uniquely by one organization, and the supporting processes are also provided by that organization.

Under these circumstances, each key process is operating in its own environment, and although for instance, project planning might be performed differently in each organization, this should not affect the ability of each key process to continue to perform to its assessed capability.

It is not possible to construct a capability, however, for the supporting processes. One organization could not provide the *management project process* in support of a number of key processes from different organizations, unless the process was identical in its implementation (not just identical in capability) across those different organizations - which is improbable.

Conjoint mode covers the more complex situation where two or more organizations are deploying the same key process(es) in parallel. It is not valid to average the process attribute ratings across different organizations. Hence either the worst capability - representing the weakest link in the chain - may be proposed, or all of the ratings, or some combination of minimum, maximum and median may be specified to provide a more informative representation of capability.

Once again, the inclusion of additional processes from the Management, Support and Organization process categories, other than those needed to support process attributes of individual key processes, is likely to be confusing unless each additional process is clearly identified as relating to a specific key process.

The constructed capability should be representative of the capability of each process in isolation. However, because two or more organizations are involved, there may also be unexpected interface issues between organizations which would not arise if the process were deployed within a single organization. The organization proposing the constructed capability and the sponsor should ensure that suitable mechanisms have been identified to address these issues. The more complex the constructed capability, and the more disparate the implementation of the processes within the organizations, the more probable it is that interfacing problems will occur.

Because there may be many ways of combining various processes within various organisations into a constructed capability, the sponsor will have to apply professional judgement in determining how best to carry out the capability determination in such cases.

5.2.2 The verification and risk analysis stage

Verification within core process capability determination is concerned merely with checking that the assessed capability is a true representation of the organization's processes. Within extended process capability determination, extended verification also involves checking:

— the credibility of the process improvement plans upon which the proposed capability is based;

— the integrity of the constructed capability.

ICS 35.080

Descriptors: data processing, information interchange, computers, computer software, estimation, process assessment, rules (instructions).

Price based on 17 pages